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Norton Sound Winter Red King Crab Studies, 1996

by

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INTRODUCTION

Red king crab *Paralithodes camtschaticus* support commercial and subsistence harvests in Norton Sound, with the greatest effort concentrated in the vicinity of Nome. Commercial fisheries occur during both summer and winter months, while subsistence fisheries occur primarily in winter months. Shorefast ice in good condition allows relatively easy access to the king crab population that is concentrated nearer to shore and is accessible from December through April. A winter king crab test fishing project began in February of 1982 in an attempt to monitor the nearshore distribution, abundance, life history and biological data of red king crab. Sampling procedures were standardized in 1983. Results of prior studies were reported by Schwarz and Lean (1982, 1983, 1984), Lean and Brannian (1987), Lean (1987), Bue and Lean (1989), Knuepfer and Gebhard (1990), Brennan and Anderson (1993), Brennan (1993), and Brennan and LaFlamme (1995).

Shorefast and sea ice conditions constantly change. From 1982 to 1987, test fishing stations were restricted to a narrow section of shorefast ice extending ½ to 2 miles directly offshore from the Nome State office building. Poor ice conditions prevented test fishing in 1988. During the 1989 and 1990 seasons, the study area was expanded 6 miles to the west of Nome, in the vicinity of gold dredging activity, and 6 miles to the east of Nome, where there is very little subsistence crabbing effort. Test fishing was reduced in 1991 and 1993 by budget constraints and poor ice. Test fishing was not funded in 1992 and 1994.

The objectives for the 1996 winter field season were to:

1. Monitor the number of sublegal and legal male red king crab and the shell age of each age class to evaluate recruitment into the legal population prior to the summer fishery.

2. Document the abundance and distribution of red king crab that may be accessible to winter users in the Nome area.

3. Document the abundance and distribution of red king crab in the Bluff area 50 miles east of Nome, if ice and travel conditions permitted.

4. Document the intensity and distribution of winter fishing effort in the Nome area.

5. Tag all male new shell red king crab with a carapace length <=100mm.

6. Monitor the size and number of female red king crab and estimate egg development and clutch size.

7. Document the timing and locations of the early benthic stages of young of the year red king crab by deploying juvenile collectors under the ice to be retrieved during the summer.

8. Monitor other life history and biological data such as disease, parasitism, and the incidence of competing species.

METHODS

Eighteen test fishing stations and six young of the year collection stations were established spanning an area from 14 miles west to 50 miles east of Nome (Figures 1 and 2). Eight historical stations, directly offshore from and to the west of Nome were reestablished. The four historical stations to the east of Nome were not reestablished because of unstable ice conditions. Ten new stations were established as ice conditions allowed. Six additional stations for collecting young of the year were established. Each station was located in water ranging from 40 ft to 55 ft deep and from approximately ½ mile to 2 miles offshore. Travel to and from Nome and the stations was by snowmachines towing sleds to carry supplies and equipment.

Station locations were established by first drilling a test hole using gasoline powered ice augers and checking the water depth using a weighted string. When a location with appropriate water depth was found, a hole about 5 ft in diameter was cut in the ice using ice augers. Other tools used included ice chisels, axes, shovels, and ice picks on long poles. Conical, four foot diameter "Japanese style" king crab pots were baited with chopped fall herring in two one quart bait containers and one string of 4 to 7 whole saffron cod. Each pot was deployed and attached to a tethered line at the surface of the ice. Each hole was covered with a plywood or styrofoam door to reduce refreezing of the hole. All holes were marked as per regulation. A personal GPS (Global Positioning System) navigator was used to record all station locations.

When pots were checked, they were brought to the surface and suspended so that all crab in the pot remained immersed in water. Crab were removed one at a time and legal and biological measurements were made to the nearest mm. Shell age was determined. Egg development on females was noted. New shell male crab with a carapace length of 100mm or less were tagged with hog ring or spaghetti tags. Any prior injuries on the crabs that were tagged were noted.

Whenever the wind chill temperature was below 15°F, crab were processed inside a warming barrel. All crab were released into the same hole that the pot was suspended in. Weather permitting, all pots were pulled, sampled, rebaited and redeployed twice weekly.

Catch per unit effort (CPUE) was calculated as the catch per pot lift.

The juvenile collectors were constructed, assembled and deployed according to the methods described by Blau, Donaldson and Byersdorfer (1990), and by Blau and Byersdorfer (1994). The methods were modified by coiling the buoy rope and buoy and adding a 90 day galvanic time release, so that the rope and buoy remained coiled well under the active ice layer until after the ice went out. After the ice went out and the 90 day time release period, the rope and buoy uncoil and come to the surface for retrieval by boat.

RESULTS

Stations were deployed beginning on 6 February, 1996. Poor ice conditions throughout the season prevented the deployment of the four historic stations to the east of Nome. New stations West 7 through West 10 were established approximately ½ mile apart in an area of stable ice extending west from station West 5. Ice movement beginning on 27 February moved stations Nome 2, Nome 3, West 3 and West 4. On 12 March, stations West 3 and West 4 were recovered in an area of fractured ice with many open leads, approximately 2 miles east of their original locations; these two pots were pulled and redeployed on 13 March as Drill 3 and Drill 4 in an area of stable ice approximately 7 miles west of Nome near stations West 1 and 2. Searches for the Nome 2 and 3 stations were unsuccessful. These two stations were probably destroyed by ice fracturing and movement. Four new stations in the vicinity of Bluff, approximately 50 miles east of Nome, were established after the day length increased and sufficient snow had fallen to make travel practical. The Juvenile Collectors 1 and 2 were placed near station West 10, in 50 ft and 40 ft of water, respectively to compare the relative abundance of juveniles at these depths. Juvenile Collectors 3 through 6 were distributed throughout the study area. Pot and juvenile collector locations, distances from Nome, and distances offshore were computed and recorded using a GPS navigator. The water depth at each station was recorded using a weighted string (Table 1).

A total of 1,608 male and 26 female red king crab were captured and sampled at 18 stations between 6 February and 17 April 1996 (Table 2). A total of 159 pot lifts were made at the 18 stations for a mean catch per pot lift (CPUE) of 9.9 male and 0.2 female red king crab. Daily catch information is presented in Table 3. A total 854 male red king crab were tagged. The size classification of

male crab is summarized in Table 4. Other species captured included Arctic Lyre crab *Hyas coarctatus*, Flatbottom sea star *Asterias amurensis*, sea urchins of the genus *Strongylocentrotus*, snails of the genus *Neptunea*, and jellyfish.

From 28 March to the end of the season four pots were fished in the vicinity of Bluff, approximately 45 to 50 miles east of Nome. The CPUE in the Bluff area was 20.6 crabs per pot lift, while it was 6.3 crabs per pot lift in the Nome area during the same period of time. The composition of the catch was similar in both locations (Table 5).

Carapace length measurements and shell age observations were taken from 1,582 male crab. Of the total male crab catch, 1,018 or 64.3% were prerecruits, 160 or 10.1% were recruits, and 404 or 25.5% were post recruits (Table 4). Prerecruit threes (carapace length <76mm) were 9.2% of the total male crab catch. Prerecruit twos (carapace length 76 to 89 mm) were 22.1% of the total male crab catch. Prerecruit ones (carapace length >89mm) were 33.1% of the total male crab catch (Table 6). The length distribution of all male crab captured during the season ranged from 62 mm to 158 mm (Figure 3). The mean length for all male crab captured was 98.9 mm.

Legal male crab were 35.7% of the total male crab catch. The mean carapace length of the 564 legal male crab caught was 117.3 mm. New shell male crab had a mean carapace length of 115.5mm and were 52% of the legal catch and old shell male crab had a mean carapace length of 119.3mm and were 48% of the legal catch. Recruits were 28.4% and postrecruits were 71.6% of the legal male crab catch (Table 7).

Sublegal male crab were 64.3% of the total male crab catch. The mean carapace length of the 1,018 sublegal male crab caught was 88.7 mm. New shell sublegal male crab with a mean carapace length of 88.3 mm were 97% of the sublegal male catch. Old shell sublegal male crab with a mean carapace length of 99.3 mm were 3% of the sublegal male catch (Table 8).

A total of 26 female crab were captured, 17 juveniles and 9 adults. Five adults had full egg clutch sizes and four adults had high egg clutch sizes. The mean carapace length was 67.0 mm for juvenile female crab and was 77.1 mm for adult female crab (Table 9).

Two juvenile collectors about 0.7 mile apart were deployed approximately 14 miles from Nome, at the west end of the study area, on 27 March, 1996. To determine if water depth is a factor in locating juvenile red king crab, Collector 1 was deployed in water 50 ft deep and Collector 2 was deployed in water 40 ft deep. The remainder of the juvenile collectors were deployed to determine if general location is a factor in locating juvenile red king crab. Collector 3 was deployed approximately 7 miles west of Nome on 27 March. Collector 4 was

deployed approximately 4 miles east of Nome on 2 April. Collector 5 was deployed approximately 45 miles east of Nome, and Collector 6 approximately 50 miles east of Nome, on 3 April. All collectors were deployed with their buoy ropes and buoys coiled and held well below the sea ice by galvanic time releases. Around 1 July, 1996, after the sea ice has cleared from the study area, the time releases should break and the buoys should surface. At that time, the juvenile collectors will be retrieved by boat and the catch of juvenile red king crab determined in the lab in the Nome office.

DISCUSSION

The winter pot survey for red king crab in the vicinity of Nome has been conducted during eleven of the fourteen years since 1983. During each season of data collection, valuable information has been collected on the crab population immediately available to the residents of Nome during the winter subsistence and commercial fishery. In 1995 the study area was expanded to include traditional and nontraditional fishing locations in the Nome area. In 1996 the study area was expanded to a new area near Bluff, 50 miles east of Nome, and slightly to the west. The winter survey has provided opportunities to collect and interpret information as it relates to the winter distribution of crab and as an indicator for the potential of the summer commercial fishery. The new study area near Bluff provided additional information that helped to indicate if trends observed in the Nome area were applicable to wider areas of Norton Sound.

Beginning about 6 miles west of Nome, sea ice conditions were good throughout the season. From Nome eastward approximately 12 miles to Cape Nome ice conditions were unstable throughout the season and no test fishing stations were established in this area. On the afternoon of 27 February a lead developed from a point approximately 4 miles west of Nome to Cape Nome. The ice on the offshore side of this lead shifted and large areas of ice broke up. Four test fishing stations were moved by this shifting ice; two stations were retrieved on 12 March and two were lost. When test fishing stations were operated in the vicinity of Bluff from 26 March to 15 April, ice conditions were excellent.

Weather conditions were rarely severe enough to prevent travel to check the stations, however on several days temperatures were low enough in the morning that the crew waited for warmer temperatures in the afternoon. In February and early March there were many foggy days and the navigation functions of the GPS proved to be invaluable in finding the stations.

Subsistence fishing effort was mostly concentrated in front of Nome and within 2 miles west. After the ice in this area moved on 27 February, many subsistence crab pots were lost and most were not replaced for the rest of the season.

Because of the poor ice in the vicinity of Nome and the loss of pots, subsistence fishing effort was at a low level compared to years with better ice conditions.

Commercial fishing effort extended about 25 miles west of town and east towards Cape Nome. Many commercial pots in front of and to the east of Nome were lost to the ice movement on 27 February. About one week after the Department deployed pots in the vicinity of Bluff, commercial fishermen followed and deployed pots in the same area. Commercial effort was less than in previous years.

The 1996 winter pot survey had the highest number of pot lifts (n=159) since 1983 (Table 10). Improving weather, trail conditions and day lengths as the season progressed allowed more pots to be checked each day (Table 3). The total number of crab caught was the fourth highest, but the CPUE was the fourth lowest, since 1983 (Table 10 and Figure 4).

The 1996 sublegal crab catch rate was the third highest (64% of the total male catch) since 1983. Prerecruit threes and twos combined made up 31% and prerecruit ones made up 33% of all crab sampled; these are well above the average percentages (prerecruit threes and twos = 18.7% and prerecruit ones = 28.0%) for the years 1983 to 1995. The legal crab catch rate was the third lowest since 1983 (35.7% of the total male catch). Recruit crab made up 10.1% of all crab sampled, compared to the average of 23.2% recruits for the years 1983 to 1995. Postrecruit crab made up 25.5% of all crab sampled compared to the average of 30.1% for the years 1983 to 1995 (Table 11).

The composition of the catch of red king crab in pot surveys changed dramatically from the winter of 1995 to the winter of 1996. The percentage of prerecruit crab captured was 23% during the winter of 1995, 38% during the summer of 1995 pot survey, and 64% during the winter of 1996. The percentage of recruit crab captured was 32% during the winter of 1995, 20% during the summer of 1995 pot survey, and 10% during the winter of 1996. The percentage of postrecruit crab captured was 44% during the winter of 1995, 42% during the summer of 1995 pot survey, and 26% during the winter of 1996 (Table 11 and Brennan 1996). The length frequency distributions of all male crab captured during the winter and summer of 1995 and the winter of 1996 pot surveys are compared in Figure 5.

The four test fishing stations at Bluff had the highest CPUE's of all stations (Table 2). However, the CPUE at Bluff dropped by 50% between 3 April and 10 April, 1996 (Table 3). This drop in CPUE coincided with arrival of commercial fisherman in the Bluff area. The length frequency distribution of all male crab captured at Bluff and the length frequency distribution of all male crab captured in the Nome area during the same time period were similar. The percentages of prerecruit, recruit, and postrecruit crab captured at Bluff was similar to the

percentages of crab captured in the Nome area during the same time period (Figure 6).

A total of 10 tagged crab were recaptured and rereleased during the pot survey. Two of these tagged crab were initially tagged during the winter of 1995, the other eight were tagged during the winter of 1996. A total of 19 tagged crabs captured during the winter fishery were turned in to the Department by commercial and subsistence fishers, 14 were tagged during the winter of 1996, 4 were tagged during the winter of 1995, and 1 was tagged during the winter of 1991 (Table 14). During the first days of the pot survey, 45 male crab with carapace lengths >100mm were tagged because the crew leader misunderstood instructions.

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Table 1. Location of test fishing stations for the winter red king crab pot survey, Norton Sound, 1996.

Pot	Location from Town	Longitude	Latitude	Depth (ft)	Distance Offshore (mi)	Historical Station	Remarks
Nome 2	0.89 miles South	N 64°29.142'	W 165°24.567'	40	0.89	yes	Pot lost to ice movement 2/27/96.
Nome 3	1.48 miles South	N 64°28.624'	W 165°24.697'	50	1.48	yes	Pot lost to ice movement 2/27/96.
West 3	3.02 miles West	N 64°29.455'	W 165°30.003'	40	1.20	yes	Ice moved pot 2/27. Recovered 3/12/96.
West 4	2.70 miles West	N 64°29.355'	W 165°29.307'	40	1.20	yes	Ice moved pot 2/27. Recovered 3/12/96.
West 1	6.71 miles West	N 64°30.741'	W 165°37.325'	40	0.74	yes	
West 2	6.80 miles West	N 64°30.360'	W 165°37.606'	50	1.20	yes	
Drill 3	7.09 miles West	N 64°30.425'	W 165°38.202'	50	1.10	no	Relocated pot W3 after it was recovered.
Drill 4	7.59 miles West	N 64°30.492'	W 165°39.191'	45	1.20	no	Relocated pot W4 after it was recovered.
West 5	11.9 miles West	N 64°30.893'	W 165°47.715'	40	1.70	yes	
West 6	11.7 miles West	N 64°30.814'	W 165°47.382'	45	1.77	yes	
West 7	12.7 miles West	N 64°31.010'	W 165°49.390'	42	1.75	no	
West 8	13.0 miles West	N 64°30.860'	W 165°50.087'	43	1.80	no	
West 9	13.6 miles West	N 64°30.840'	W 165°51.236'	45	1.90	no	
West 10	14.1 miles West	N 64°30.804'	W 165°52.292'	42	1.80	no	
Bluff 1	44.9 miles East	N 64°33.304'	W 163°54.030'	40	0.50	no	
Bluff 2	46.8 miles East	N 64°33.029'	W 163°50.221'	43	1.50	no	
Bluff 3	48.6 miles East	N 64°32.521'	W 163°46.531'	48	1.50	no	
Bluff 4	50.3 miles East	N 64°31.976'	W 163°42.868'	55	1.50	no	

Juvenile Collector	Location from Town	Longitude	Latitude	Depth (ft)	Distance Offshore (mi)	Historical Station	Remarks
Collector 1	14.1 Miles West	N 64°30.810'	W 165°52.289'	50	1.81	no	Deployed 3/27/96
Collector 2	14.1 Miles West	N 64°31.390'	W 165°51.987'	40	1.13	no	Deployed 3/27/96
Collector 3	6.79 miles West	N 64°30.411'	W 165°37.584'	50	1.21	no	Deployed 3/27/96
Collector 4	4.03 miles East	N 64°27.734'	W 165°17.501'	42	1.20	no	Deployed 4/2/96
Collector 5	44.9 miles East	N 64°33.303'	W 163°54.005'	40	0.50	no	Deployed 4/3/96
Collector 6	50.3 miles East	N 64°32.062'	W 163°42.915'	55	1.50	no	Deployed 4/3/96

Table 2. Number of pot lifts and catch, by station, for all stations in the winter red king crab pot survey, Norton Sound, 1996.

Station	Dates Fished	Number of Pot Lifts	Number of Male Red King Crab Caught	CPUE for Male Red King Crab	Number of Female Red King Crab Caught	CPUE for Female Red King Crab
Nome 2	2/6 - 2/22/96	5	29	5.8	1	0.2
Nome 3	2/6 - 2/26/96	6	59	9.8	0	0.0
West 1	2/7 - 4/17/96	16	113	7.1	2	0.1
West 2	2/7 - 4/17/96	16	169	10.6	4	0.3
West 3	2/7 - 3/12/96	7	38	5.4	0	0.0
West 4	2/8 - 3/12/96	6	100	16.7	4	0.7
Drill 3	3/13 - 4/17/96	8	80	10.0	3	0.4
Drill 4	3/13 - 4/17/96	8	94	11.8	0	0.0
West 5	2/8 - 4/16/96	16	221	13.8	3	0.2
West 6	3/5 - 4/16/96	11	84	7.6	2	0.2
West 7	3/5 - 4/16/96	11	60	5.5	0	0.0
West 8	3/5 - 4/16/96	11	63	5.7	0	0.0
West 9	3/6 - 4/16/96	11	50	4.5	3	0.3
West 10	3/6 - 4/16/96	11	92	8.4	1	0.1
Bluff 1	3/26 - 4/15/96	4	105	26.3	1	0.3
Bluff 2	3/26 - 4/15/96	4	83	20.8	1	0.3
Bluff 3	3/26 - 4/15/96	4	68	17.0	1	0.3
Bluff 4	3/26 - 4/15/96	4	74	18.5	0	0.0
Total		159	1582	9.9	26	0.2

Table 3. Daily catch of red king crab for all stations in the winter pot survey, Norton Sound, 1996.

Date	Vicinity	# of Pots Lifted	# of Males Captured	Male CPUE	Cumulative # of Males Captured	# of Females Captured
9-Feb	Nome West	5	27	5.4	27	
13-Feb	Nome	2	20	10.0	47	
14-Feb	Nome West	5	84	16.8	131	
15-Feb	Nome	2	7	3.5	138	
16-Feb	Nome West	5	28	5.6	166	1
20-Feb	Nome West	5	55	11.0	221	
22-Feb	Nome West	4	28	7.0	249	1
26-Feb	Nome West	6	90	15.0	339	
4-Mar	West	3	72	24.0	411	
8-Mar	West	8	34	4.3	445	1
11-Mar	West	8	93	11.6	538	
12-Mar	Nome	2	22	11.0	560	3
14-Mar	West	8	80	10.0	640	
18-Mar	West	9	123	13.7	763	7
19-Mar	West	1	19	19.0	782	
22-Mar	West	10	90	9.0	872	1
28-Mar	West	10	103	10.3	975	4
29-Mar	Bluff	4	99	24.8	1,074	3
1-Apr	West	10	90	9.0	1,164	5
3-Apr	Bluff	4	138	34.5	1,302	
5-Apr	West	10	59	5.9	1,361	
8-Apr	West	10	31	3.1	1,392	
10-Apr	Bluff	4	60	15.0	1,452	
12-Apr	West	10	51	5.1	1,503	
15-Apr	Bluff	4	33	8.3	1,536	
16-Apr	West	6	25	4.2	1,561	
17-Apr	West	4	21	5.3	1,582	
		159	1,582	9.9		26

Table 4. Summary of male red king crab data from the winter pot survey, Norton Sound, 1996.

Sublegal Males				Legal Males			
New Shell		Old Shell		New Shell		Old Shell	
Number	Percent	Number	Percent	Number	Percent	Number	Percent
987	62.4%	31	2.0%	293	18.5%	271	17.1%

Prerecruit Males		Recruit Males		Postrecruit Males	
Number	Percent	Number	Percent	Number	Percent
1,018	64.3%	160	10.1%	404	25.5%

Male red king crab tagged = 854

Table 5. Comparison of the catches of red king crab in the Nome and Bluff areas, Norton Sound, 28 March through 17 April, 1996.

Catch of male red king crab for the Nome area pots, 28 March through 17 April, 1996

Catch	380		
Pot Lifts	60		
CPUE	6.3		
			Average Length
Prerecruits	261	68.7%	87.0 mm
Recruits	37	9.7%	109.1 mm
Postrecruits	82	21.6%	121.1 mm

Catch of male red king crab for the Bluff area pots, 28 March through 17 April, 1996

Catch	330		
Pot Lifts	16		
CPUE	20.6		
			Average Length
Prerecruits	220	66.7%	92.5 mm
Recruits	40	12.1%	109.2 mm
Postrecruits	70	21.2%	119.4 mm

Table 6. Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1996.

Carapace Length (mm)	Prerecruits Number	Prerecruits Percent	Recruits Number	Recruits Percent	Postrecruits Number	Postrecruits Percent	Totals	%
60	0	0.0%					0	0.0%
61	0	0.0%					0	0.0%
62	2	0.1%					2	0.1%
63	0	0.0%					0	0.0%
64	1	0.1%					1	0.1%
65	1	0.1%					1	0.1%
66	10	0.6%					10	0.6%
67	4	0.3%					4	0.3%
68	14	0.9%					14	0.9%
69	14	0.9%					14	0.9%
70	11	0.7%					11	0.7%
71	12	0.8%					12	0.8%
72	18	1.1%					18	1.1%
73	17	1.1%					17	1.1%
74	20	1.3%					20	1.3%
75	21	1.3%					21	1.3%
76	17	1.1%					17	1.1%
77	21	1.3%					21	1.3%
78	22	1.4%					22	1.4%
79	24	1.5%					24	1.5%
80	15	0.9%					15	0.9%
81	22	1.4%					22	1.4%
82	25	1.6%					25	1.6%
83	28	1.8%					28	1.8%
84	26	1.6%					26	1.6%
85	23	1.5%					23	1.5%
86	20	1.3%					20	1.3%
87	26	1.6%					26	1.6%
88	41	2.6%					41	2.6%
89	40	2.5%					40	2.5%
90	35	2.2%					35	2.2%
91	34	2.1%					34	2.1%
92	45	2.8%					45	2.8%
93	35	2.2%					35	2.2%
94	40	2.5%					40	2.5%
95	30	1.9%					30	1.9%
96	32	2.0%					32	2.0%
97	44	2.8%					44	2.8%
98	25	1.6%					25	1.6%
99	37	2.3%					37	2.3%
100	30	1.9%					30	1.9%
101	18	1.1%	2	0.1%			20	1.3%
102	30	1.9%	2	0.1%			32	2.0%
103	28	1.8%	8	0.5%	1	0.1%	37	2.3%
104	21	1.3%	4	0.3%	5	0.3%	30	1.9%
105	12	0.8%	10	0.6%	4	0.3%	26	1.6%
106	14	0.9%	9	0.6%	3	0.2%	26	1.6%
107	7	0.4%	14	0.9%	2	0.1%	23	1.5%
108	3	0.2%	18	1.1%	9	0.6%	30	1.9%
109	2	0.1%	16	1.0%	12	0.8%	30	1.9%
110	1	0.1%	12	0.8%	10	0.6%	23	1.5%
111			16	1.0%	6	0.4%	22	1.4%
112			14	0.9%	20	1.3%	34	2.1%
113			15	0.9%	9	0.6%	24	1.5%
114			12	0.8%	11	0.7%	23	1.5%
115			8	0.5%	14	0.9%	22	1.4%
116					26	1.6%	26	1.6%
117					20	1.3%	20	1.3%
118					24	1.5%	24	1.5%
119					15	0.9%	15	0.9%
120					26	1.6%	26	1.6%
Totals	1,018	64.3%	160	10.1%				

Postrecruits (continued)

Carapace Length (mm)	Number	Percent	Totals	%
121	20	1.3%	20	1.3%
122	28	1.8%	28	1.8%
123	16	1.0%	16	1.0%
124	7	0.4%	7	0.4%
125	15	0.9%	15	0.9%
126	15	0.9%	15	0.9%
127	10	0.6%	10	0.6%
128	17	1.1%	17	1.1%
129	10	0.6%	10	0.6%
130	7	0.4%	7	0.4%
131	3	0.2%	3	0.2%
132	7	0.4%	7	0.4%
133	4	0.3%	4	0.3%
134	5	0.3%	5	0.3%
135	2	0.1%	2	0.1%
136	4	0.3%	4	0.3%
137	1	0.1%	1	0.1%
138	5	0.3%	5	0.3%
139	1	0.1%	1	0.1%
140	1	0.1%	1	0.1%
141	1	0.1%	1	0.1%
142	0	0.0%	0	0.0%
143	1	0.1%	1	0.1%
144	1	0.1%	1	0.1%
145	0	0.0%	0	0.0%
146	1	0.1%	1	0.1%
147	0	0.0%	0	0.0%
148	1	0.1%	1	0.1%
149	2	0.1%	2	0.1%
150	0	0.0%	0	0.0%
151	0	0.0%	0	0.0%
152	0	0.0%	0	0.0%
153	1	0.1%	1	0.1%
154	0	0.0%	0	0.0%
155	0	0.0%	0	0.0%
156	0	0.0%	0	0.0%
157	0	0.0%	0	0.0%
158	1	0.1%	1	0.1%
159	0	0.0%	0	0.0%
160	0	0.0%	0	0.0%
Totals	404	25.5%	1,582	100.0%

Number of Prerecruit threes (< 76mm)	145	9.2%
Number of Prerecruit twos (76 to 89 mm)	350	22.1%
Number of prerecruit ones (> 89mm)	523	33.1%

Average Length = 98.9 mm

Table 7. Length frequencies by shell age of all legal male red king crab captured in the winter pot survey, Norton Sound, 1996.

Carapace Length (mm)	Legal New Shell Males		Legal Old Shell Males		Total Legal Males	
	Number	Percent	Number	Percent	Number	Percent
100	0	0.0%	0	0.0%	0	0.0%
101	2	0.4%	0	0.0%	2	0.4%
102	2	0.4%	0	0.0%	2	0.4%
103	8	1.4%	1	0.2%	9	1.6%
104	4	0.7%	5	0.9%	9	1.6%
105	10	1.8%	4	0.7%	14	2.5%
106	9	1.6%	3	0.5%	12	2.1%
107	14	2.5%	2	0.4%	16	2.8%
108	18	3.2%	9	1.6%	27	4.8%
109	16	2.8%	12	2.1%	28	5.0%
110	12	2.1%	10	1.8%	22	3.9%
111	16	2.8%	6	1.1%	22	3.9%
112	14	2.5%	20	3.5%	34	6.0%
113	15	2.7%	9	1.6%	24	4.3%
114	12	2.1%	11	2.0%	23	4.1%
115	8	1.4%	14	2.5%	22	3.9%
116	13	2.3%	13	2.3%	26	4.6%
117	11	2.0%	9	1.6%	20	3.5%
118	9	1.6%	15	2.7%	24	4.3%
119	4	0.7%	11	2.0%	15	2.7%
120	15	2.7%	11	2.0%	26	4.6%
121	10	1.8%	10	1.8%	20	3.5%
122	14	2.5%	14	2.5%	28	5.0%
123	10	1.8%	6	1.1%	16	2.8%
124	4	0.7%	3	0.5%	7	1.2%
125	7	1.2%	8	1.4%	15	2.7%
126	7	1.2%	8	1.4%	15	2.7%
127	2	0.4%	8	1.4%	10	1.8%
128	11	2.0%	6	1.1%	17	3.0%
129	4	0.7%	6	1.1%	10	1.8%
130	1	0.2%	6	1.1%	7	1.2%
131	1	0.2%	2	0.4%	3	0.5%
132	2	0.4%	5	0.9%	7	1.2%
133	1	0.2%	3	0.5%	4	0.7%
134	2	0.4%	3	0.5%	5	0.9%
135	0	0.0%	2	0.4%	2	0.4%
136	1	0.2%	3	0.5%	4	0.7%
137	0	0.0%	1	0.2%	1	0.2%
138	1	0.2%	4	0.7%	5	0.9%
139	0	0.0%	1	0.2%	1	0.2%
140	0	0.0%	1	0.2%	1	0.2%
141	0	0.0%	1	0.2%	1	0.2%
142	0	0.0%	0	0.0%	0	0.0%
143	1	0.2%	0	0.0%	1	0.2%
144	0	0.0%	1	0.2%	1	0.2%
145	0	0.0%	0	0.0%	0	0.0%
146	1	0.2%	0	0.0%	1	0.2%
147	0	0.0%	0	0.0%	0	0.0%
148	0	0.0%	1	0.2%	1	0.2%
149	0	0.0%	2	0.4%	2	0.4%
150	0	0.0%	0	0.0%	0	0.0%
151	0	0.0%	0	0.0%	0	0.0%
152	0	0.0%	0	0.0%	0	0.0%
153	1	0.2%	0	0.0%	1	0.2%
154	0	0.0%	0	0.0%	0	0.0%
155	0	0.0%	0	0.0%	0	0.0%
156	0	0.0%	0	0.0%	0	0.0%
157	0	0.0%	0	0.0%	0	0.0%
158	0	0.0%	1	0.2%	1	0.2%
159	0	0.0%	0	0.0%	0	0.0%
160	0	0.0%	0	0.0%	0	0.0%
Totals	293	52.0%	271	48.0%	564	100.0%
Average Length	115.5 mm		119.3 mm		117.3 mm	

Total Recruits	160	28.4%
Total Postrecruits	404	71.6%

Table 8. Length frequencies by shell age of all sublegal male red king crab captured in the winter pot survey, Norton Sound, 1996.

	Sublegal New Shell Males				Sublegal Old Shell Males				
Carapace Length (mm)	Threes (<76 mm)	Twos (76 to 89 mm)	Ones (>89 mm)	%	Threes (<76 mm)	Twos (76 to 89 mm)	Ones (>89 mm)	%	Total Sublegal Males	%
60	0			0.0%	0			0.0%	0	0.0%
61	0			0.0%	0			0.0%	0	0.0%
62	2			0.2%	0			0.0%	2	0.2%
63	0			0.0%	0			0.0%	0	0.0%
64	1			0.1%	0			0.0%	1	0.1%
65	1			0.1%	0			0.0%	1	0.1%
66	10			1.0%	0			0.0%	10	1.0%
67	4			0.4%	0			0.0%	4	0.4%
68	14			1.4%	0			0.0%	14	1.4%
69	14			1.4%	0			0.0%	14	1.4%
70	11			1.1%	0			0.0%	11	1.1%
71	12			1.2%	0			0.0%	12	1.2%
72	18			1.8%	0			0.0%	18	1.8%
73	17			1.7%	0			0.0%	17	1.7%
74	20			2.0%	0			0.0%	20	2.0%
75	21			2.1%	0			0.0%	21	2.1%
76		17		1.7%		0		0.0%	17	1.7%
77		21		2.1%		0		0.0%	21	2.1%
78		22		2.2%		0		0.0%	22	2.2%
79		24		2.4%		0		0.0%	24	2.4%
80		15		1.5%		0		0.0%	15	1.5%
81		22		2.2%		0		0.0%	22	2.2%
82		25		2.5%		0		0.0%	25	2.5%
83		28		2.8%		0		0.0%	28	2.8%
84		25		2.5%		1		0.1%	26	2.6%
85		23		2.3%		0		0.0%	23	2.3%
86		19		1.9%		1		0.1%	20	2.0%
87		25		2.5%		1		0.1%	26	2.6%
88		40		3.9%		1		0.1%	41	4.0%
89		40		3.9%		0		0.0%	40	3.9%
90			35	3.4%			0	0.0%	35	3.4%
91			34	3.3%			0	0.0%	34	3.3%
92			44	4.3%			1	0.1%	45	4.4%
93			35	3.4%			0	0.0%	35	3.4%
94			38	3.7%			2	0.2%	40	3.9%
95			30	2.9%			0	0.0%	30	2.9%
96			31	3.0%			1	0.1%	32	3.1%
97			43	4.2%			1	0.1%	44	4.3%
98			24	2.4%			1	0.1%	25	2.5%
99			37	3.6%			0	0.0%	37	3.6%
100			27	2.7%			3	0.3%	30	2.9%
101			18	1.8%			0	0.0%	18	1.8%
102			22	2.2%			8	0.8%	30	2.9%
103			25	2.5%			3	0.3%	28	2.8%
104			17	1.7%			4	0.4%	21	2.1%
105			11	1.1%			1	0.1%	12	1.2%
106			14	1.4%			0	0.0%	14	1.4%
107			6	0.6%			1	0.1%	7	0.7%
108			3	0.3%			0	0.0%	3	0.3%
109			2	0.2%			0	0.0%	2	0.2%
110			0	0.0%			1	0.1%	1	0.1%
Totals	145	346	496	97.0%	0	4	27	3.0%	1,018	100.0%
Average Lengths (mm)	71.1	83.3	96.9		0.0	86.3	101.3		88.7 mm	

Average Length of all sublegal new shell males = 88.3 mm

Average length of all sublegal old shell males 99.3 mm

Table 9. Length frequencies and percent ovigerity of all female red king crab captured in the winter pot survey, Norton Sound, 1996.

	Percent Ovigerity						
Carapace Length (mm)	Full 90 - 100%	High 60 - 89%	Medium 30 - 59%	Low 1 - 29%	None 0%	Juvenile	Total
55							0
56							0
57							0
58							0
59						1	1
60							0
61						1	1
62							0
63						1	1
64						1	1
65						3	3
66						2	2
67							0
68						2	2
69						2	2
70							0
71							0
72	1					2	3
73						1	1
74	1	1				1	3
75		2					2
76	1						1
77							0
78							0
79							0
80	1						1
81							0
82							0
83							0
84	1	1					2
85							0
86							0
87							0
88							0
89							0
90							0
Totals =	5	4	0	0	0	17	26

Average length of juvenile females = 67.0 mm

Average length of adult females = 77.1 mm

Average length of all females = 70.5 mm

Table 10. Total catch of red king crab during the winter pot surveys, Norton Sound, 1983 - 1996.

Year	# of Pot Lifts	# of Males Captured	Male CPUE	# of Females Captured	Female CPUE
1983	107	2,586	24.2	236	2.2
1984	70	1,677	24.0	78	1.1
1985	31	760	24.5	14	0.5
1986	31	594	19.2	74	2.4
1987	26	151	5.8	6	0.2
1988 [a]					
1989	42	548	13.0	9	0.2
1990	99	2,076	21.0	18	0.2
1991	56	1,283	22.9	8	0.1
1992 [b]					
1993	33	181	5.5	1	0.0
1994 [b]					
1995	126	776	6.2	10	0.1
1996	159	1,582	9.9	26	0.2

[a] No data collected in 1988 because of unstable ice conditions.

[b] The project was not funded.

Table 11. Percent prerecruits, recruits and postrecruits in the catch of red king crab during the winter pot surveys,1983-1996, and the summer pot survey, 1995, Norton Sound.

	Sublegal Prerecruits				Legal			
Year	Threes[ab]	Twos[bc]	Ones[d]	Subtotal	Recruits	Postrecruits	Subtotal	Total
1983		26.2%	38.0%	64.2%	26.1%	9.6%	35.7%	100%
1984		34.7%	31.0%	65.6%	18.6%	15.8%	34.4%	100%
1985		24.7%	45.1%	69.8%	20.4%	9.8%	30.2%	100%
1986		25.7%	35.0%	60.7%	21.7%	17.7%	39.3%	100%
1987		12.5%	31.3%	43.8%	10.4%	45.8%	56.3%	100%
1988 [e]								
1989		26.8%	15.4%	42.2%	27.3%	30.5%	57.8%	100%
1990		15.9%	33.5%	49.4%	24.7%	26.0%	50.6%	100%
1991	0.2%	4.8%	30.6%	35.6%	33.5%	30.9%	64.4%	100%
1992 [f]								
1993	0.0%	3.3%	8.8%	12.2%	17.1%	70.7%	87.9%	100%
1994 [f]								
1995 [g]	2.1%	9.8%	11.4%	23.3%	32.3%	44.4%	76.7%	100%
1996	9.2%	22.1%	33.1%	64.3%	10.1%	25.5%	35.7%	100%
Averages 1983 - 1995	Threes and twos combined	18.7%	28.0%	46.7%	23.2%	30.1%	53.3%	

	Sublegal Prerecruits				Legal			
Year	Threes[a]	Twos[c]	Ones[d]	Subtotal	Recruits	Postrecruits	Subtotal	Total
Summer 1995	8.6%	12.4%	16.9%	37.9%	20.0%	42.1%	62.1%	100%

[a] Prerecruit threes are all sublegal males with carapace length < 76 mm.

[b] Prior to 1991 carapace lengths were consolidated in pairs so that prerecruit threes and twos cannot be accurately separated.

[c] Prerecruit twos are all sublegal males with carapace length from 76 through 89 mm.

[d] Prerecruit ones are all sublegal males with carapace length > 89 mm.

[e] No data collected due to unstable ice conditions during the winter of 1988.

[f] No data collected due to lack of funds.

[g] Includes catch from 12 testfishing stations and from one commercial fisherman catch on 5 April.

Table 12. Average length frequencies of legal male and female red king crab captured during the winter pot surveys in the Nome area, Norton Sound, 1983 - 1996.

Year	Average Length of Legal Male Crab (mm)	Average length of Female Crab (mm)
1983	[c]	[c]
1984	[c]	[c]
1985	[c]	79
1986	[c]	70
1987	[c]	71
1988 [a]		
1989	[c]	79
1990	115	83
1991	114	75
1992 [b]		
1993	118	93 [d]
1994 [b]		
1995	117	77
1996	117	71

[a] No data collected in 1988 due to unstable ice conditions.

[b] No data collected in 1992 and 1994 due to a lack of funds.

[c] Information not available.

[d] Only one female crab captured during 1993.

Table 13. Recruit and postrecruit red king crab as a percentage of the legal catch sampled during the winter pot surveys and summer commercial fisheries in the Nome area, Norton Sound, 1983 - 1996.

	Winter Study		Summer Commercial	
Year	Recruits	Postrecruits	Recruits	Postrecruits
1983	73%	27%	55%	45%
1984	54%	46%	59%	41%
1985	68%	32%	45%	55%
1986	55%	45%	48%	52%
1987	20%	80%	22%	78%
1988	[a]	[a]	25%	75%
1989	47%	53%	23%	77%
1990	49%	51%	21%	79%
1991	52%	48%	[b]	[b]
1992	[c]	[c]	28%	72%
1993	20%	80%	31%	69%
1994	[c]	[c]	14%	86%
1995	42%	58%	36%	64%
1996	28%	72%		

[a] No data collected in the winter ogf 1988 due to unstable ice conditions.

[b] No data collected in the summer of 1991 due to closed fishery.

[c] No data collected due to lack of funding.

Table 14. Tag recovery information from red king crab captured during the winter crab fishery and pot survey, Norton Sound, 1996.

Tab Number	Date of Capture	Stat. Area	Carapace Length (mm)	Shell Age	Date of Tagging	Carapace Length (mm)	Shell Age	Growth (mm)	Molts[a]	Skip Molts	Mean Growth per Molt (mm)	Fate
NX 02480	2/14/96	656403	119	New	3/18/91	107	New	12	1	4	12	Dead
NZ 02950	4/24/96	656403	112	New	3/22/95	98	New	14	1	0	14	Dead
NZ 03074	4/16/96		112	Old	3/9/95	112	New	0	0	1	0	Dead
NZ 03119	3/13/96	656403	113	New	3/27/95	107	Old	6	1	0	6	Dead
NZ 03435	3/1/96	No Information Supplied			3/28/95	109	New	No Information Supplied				Dead
NX 03214	3/26/96	656404	90	New	2/26/96	90	New	0	0	0	0	Dead
NX 03250	4/17/96	656403	90	New	2/14/96	90	New	0	0	0	0	Dead
NX 03260	3/22/96	656403	101	New	2/14/96	103	New	0	0	0	0	Dead
NX 03275	3/19/96	656403	91	New	2/14/96	91	New	0	0	0	0	Dead
NX 03277	2/21/96	656403	85	New	2/14/96	89	New	0	0	0	0	Dead
NX 03299	4/25/96	656403	92	New	2/16/96	91	New	0	0	0	0	Dead
NX 03379	4/13/96	656403	113	New	2/14/96	122	New	0	0	0	0	Dead
NX 03386	4/17/96	656403	116	Old	2/14/96	118	Old	0	0	0	0	Dead
NX 03593	4/16/96	656403	92	New	3/14/96	92	New	0	0	0	0	Dead
NX 03612	3/26/96	666432	101	New	3/18/96	100	New	0	0	0	0	Dead
NX 03658	4/17/96	656403	92	New	3/28/96	92	New	0	0	0	0	Dead
NX 03693	3/26/96	656403	89	New	3/22/96	88	New	0	0	0	0	Dead
NX 03809	4/18/96	656403	96	New	4/3/96	96	New	0	0	0	0	Dead
NX 03836	4/9/96	636403	97	New	4/3/96	99	New	0	0	0	0	Dead
NZ 03112	2/14/96	656403	107	New	3/24/95	90	New	17	1	0	17	Released
NX 03261	3/11/96	656403	121	Old	2/14/96	122	Old	0	0	0	0	Released
NZ 03121	3/12/96	656403	108	Old	3/27/95	107	New	0	0	1	0	Released
NX 03510	3/18/96	656403	97	New	3/4/96	97	New	0	0	0	0	Released
NX 03608	3/22/96	656403	100	New	3/18/96	99	New	0	0	0	0	Released
NX 02553	3/28/96	656403	80	New	2/26/96	72	New	0	0	0	0	Released
NX 03676	3/38/96	656403	91	New	3/18/96	92	New	0	0	0	0	Released
NX 02644	4/5/96	656403	76	New	3/14/96	75	New	0	0	0	0	Released
NX 03611	4/12/96	656403	89	New	3/18/96	90	New	0	0	0	0	Released
NX 03588	4/12/96	656403	89	new	3/14/96	90	New	0	0	0	0	Released

Number of Tags Recovered = 29

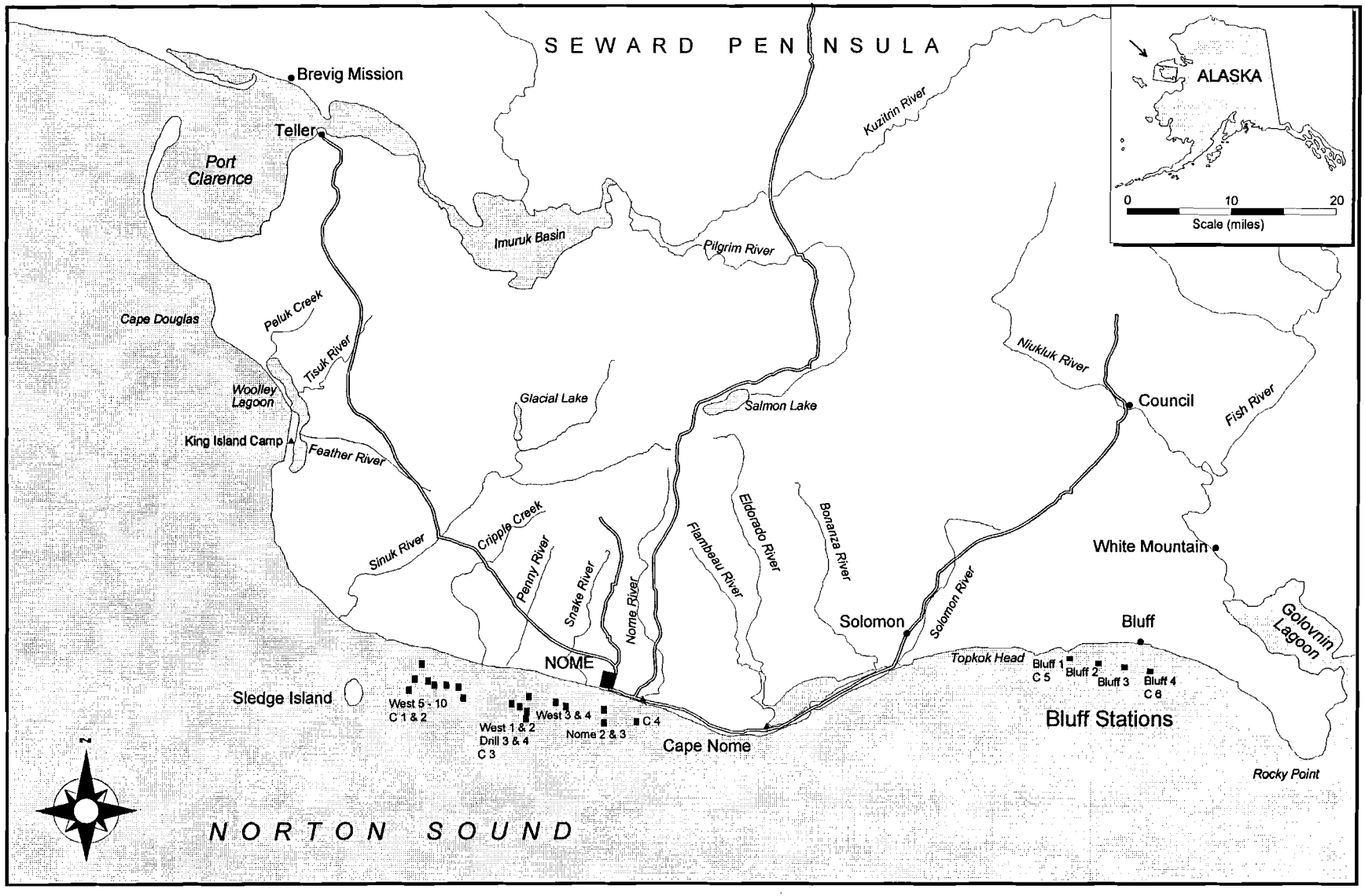


Figure 1. Area location map for the red king crab winter pot survey, Norton Sound, 1996.

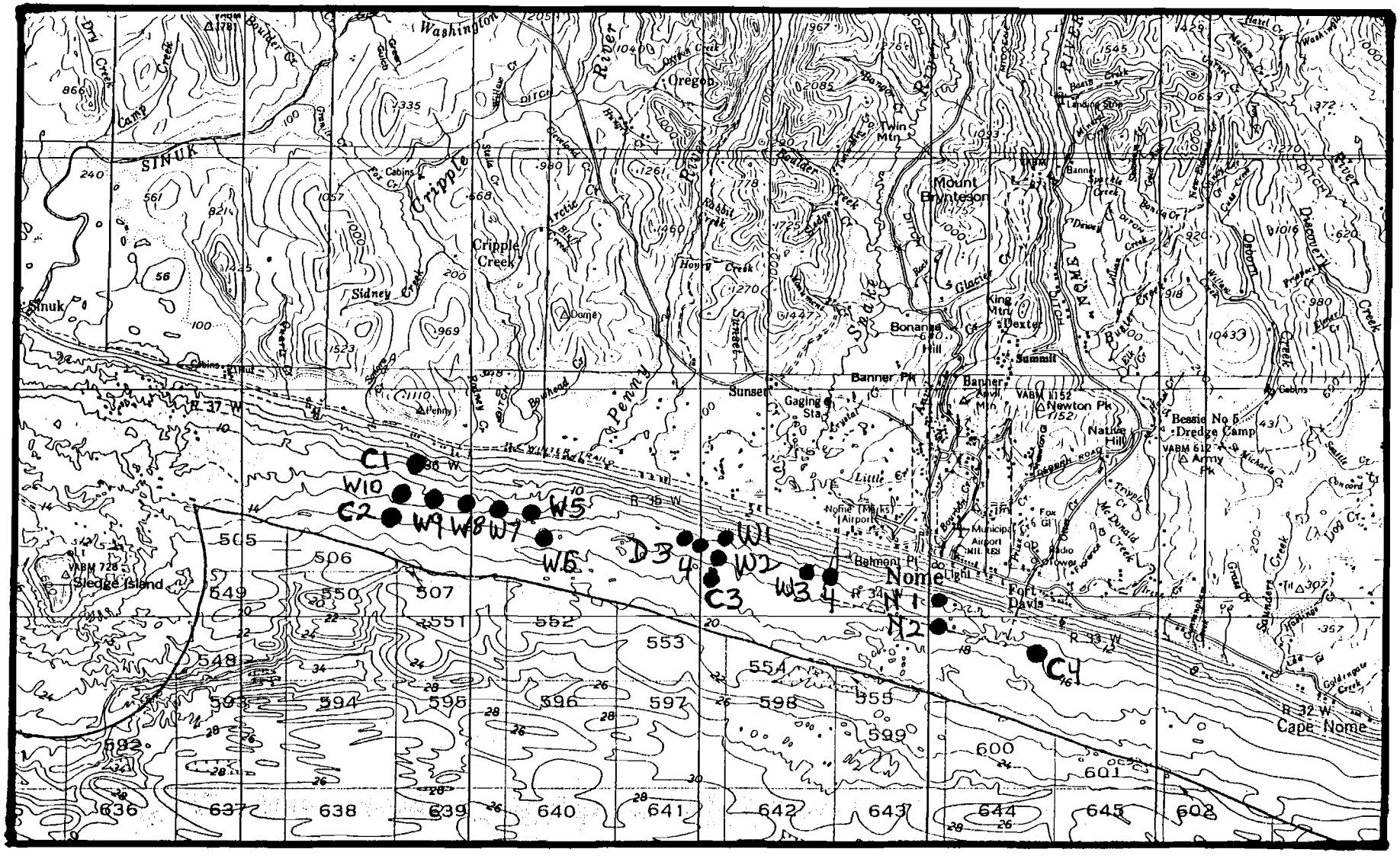


Figure 2. Detailed area location map of the Nome area for the red king crab winter pot survey, Norton Sound, 1996.

Figure 3. Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1996.

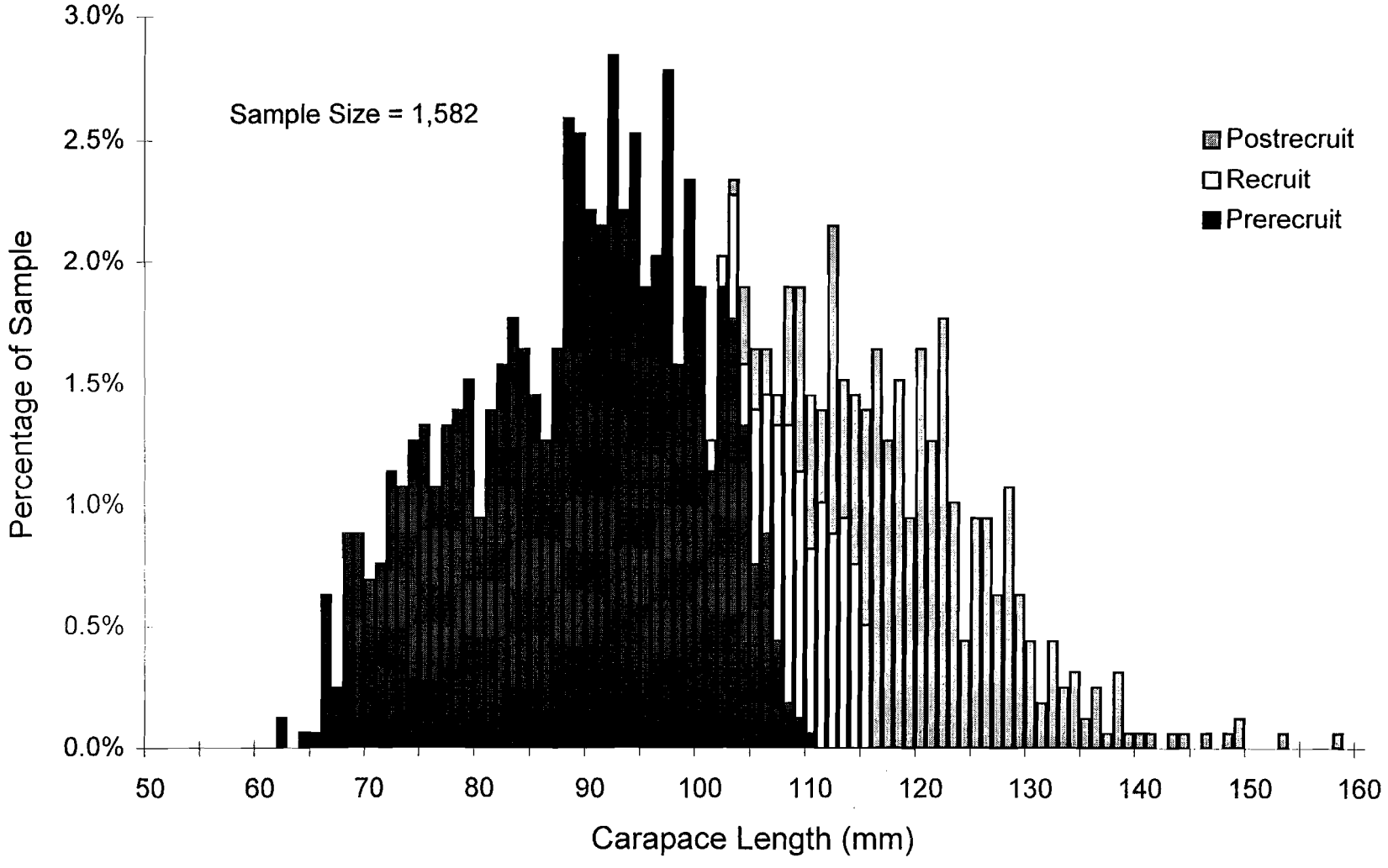
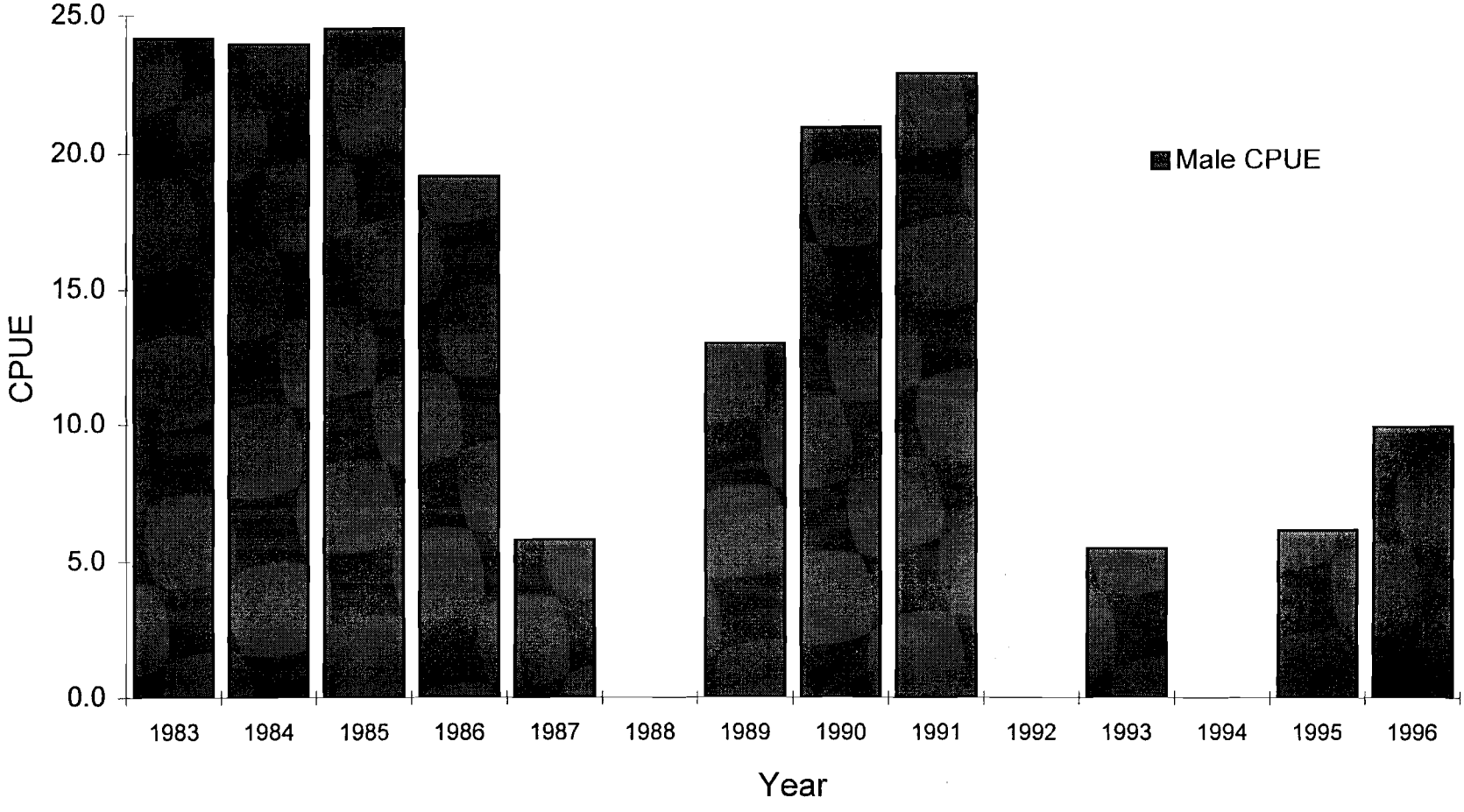


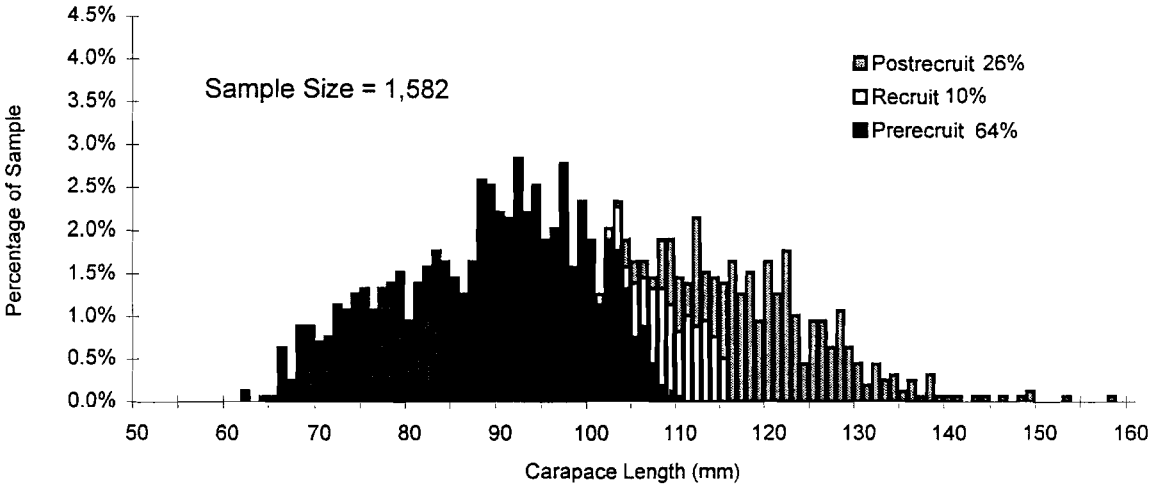
Figure 4. Annual catch per unit effort (CPUE) for male red king crab in the winter pot survey, Norton Sound, 1983 - 1996.



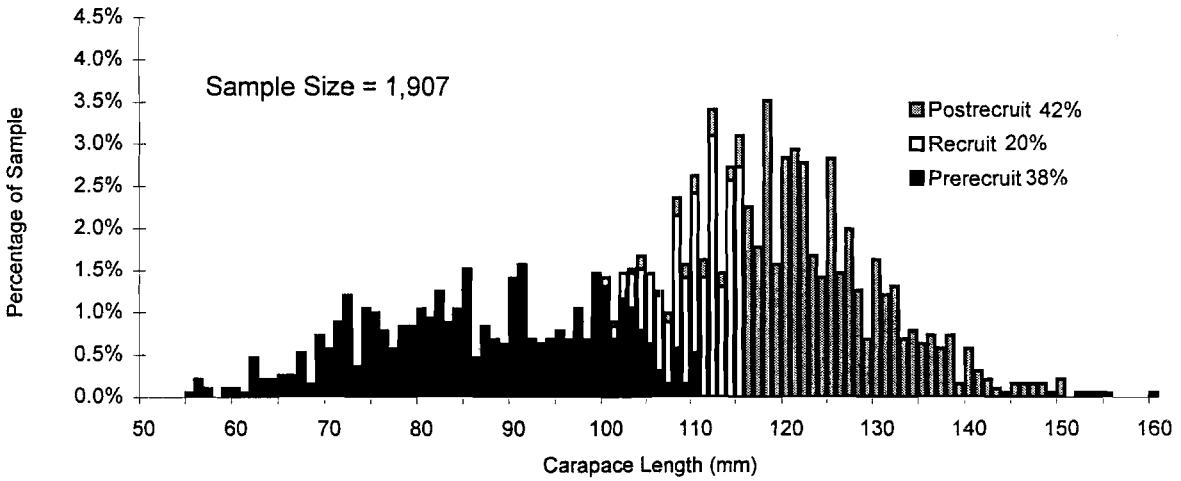
a No data collected in 1988 due to unstable ice conditions
b Project not funded in 1992 and 1994

Figure 5. Comparison of the length frequency distribution of all male red king crab captured during the pot surveys of the winter of 1996, and the winter and summer of 1995, Norton Sound.

Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 9 February to 17 April, 1996.



Length frequency distribution of all male red king crab captured during the summer pot survey, Norton Sound, 26 - 28 June, 1995.



Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 3 March to 6 April, 1995.

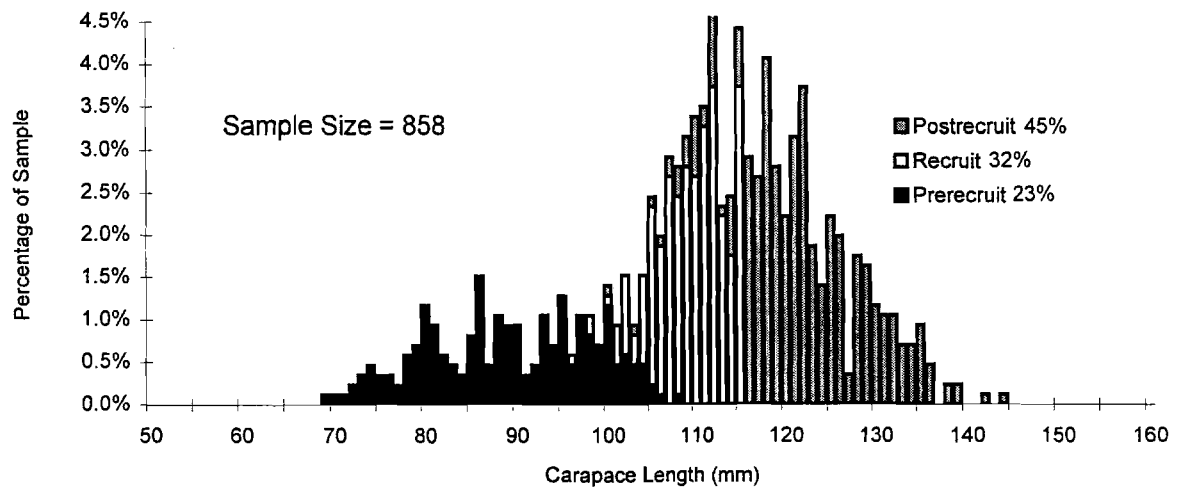
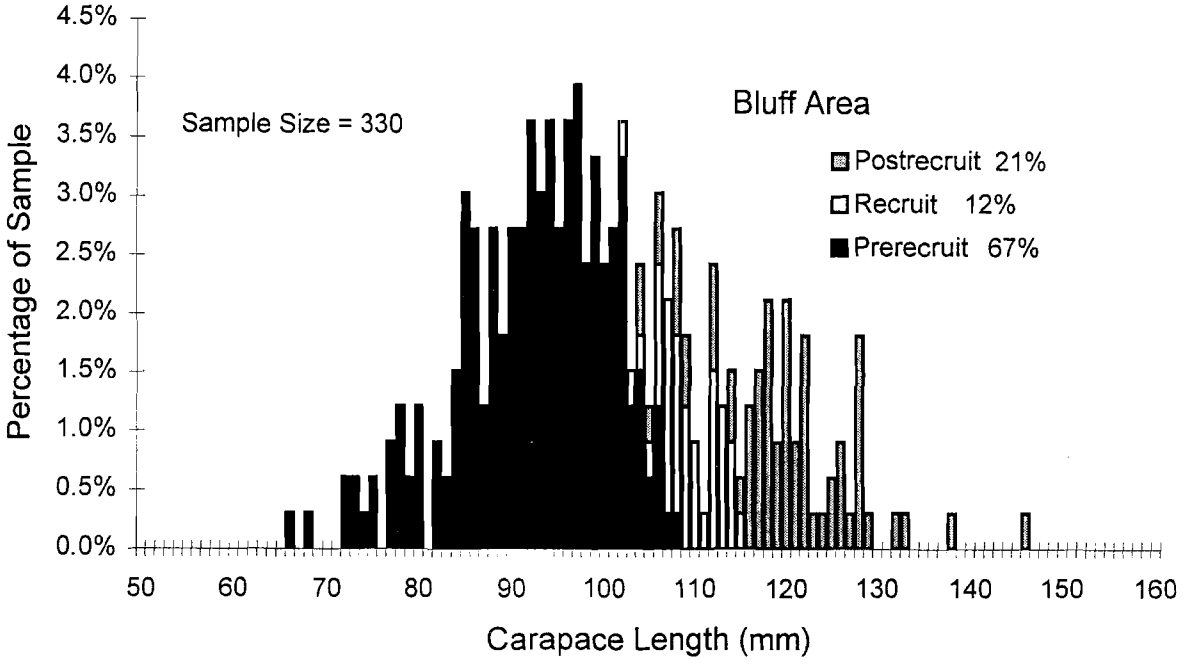


Figure 6. The length frequency distribution of all male red king crab captured in the Bluff area compared to those captured in the Nome area, Norton Sound, 28 March - 17 April, 1996.

Length frequency distribution of all male red king crab captured in the Bluff area, 28 March to 17 April, 1996.



Length frequency distribution of all male red king crab captured in the Nome area, 28 March to 17 April, 1996.